Dear Sir/Madam,

JOINT BCA / ACES / IES CIRCULAR 2019

GUIDE ON THE FORMAT OF SUBMISSION FOR STRUCTURAL PLANS

Objective

This circular aims to provide a guide on the format of structural plan submissions for Qualified Persons (QPs) and Accredited Checkers (ACs).

Background

2 Regulation 9 of the Building Control Regulations 2003 sets out the particulars to be shown on detailed structural plans and design calculations. In collaboration with ACES/IES, BCA has developed a guide on the format of structural plan submissions.

Guide on Format of Submission

3 The guide (refer Annexes A1, A2 and B) has been developed based on industry's comments and good practices from plan submissions. The templates in Annexes A1 and A2 provide a systematic listing of the structural elements for QPs and ACs to identify the structural elements designed/checked in their submissions. Annex B provides a guide on what could be included in design calculations which helps to clearly demonstrate the design of structural elements in a building.

4 To speed up the preparation of Annex A1 to list the structural elements designed and checked, QPs and ACs are advised to use the recommended design workflow involving data exchange between the structural analysis and design model and the BIM model as given in Annex C. This workflow is intended to allow for a more automated process of listing out the summary of structural elements. We will be organising briefing sessions to share on the proposed format of submission and the recommended design workflow. More details will be provided via Corenet at a later date.

5 Notwithstanding the contents and objective of this circular, ACs continue to have a non-delegable duty under Section 7 of Building Control (AC and ACO) Regulations to review the structural design in the plans of building works and perform their original calculations.

6 Please disseminate the contents of this letter to your members.
For Clarification

7 Please contact Mr. Tan Yu Jun at tel 1800 342 5222 or submit your enquiry through BCA’s Online Feedback Form at https://www.bca.gov.sg/feedbackform/, if you need any clarification. Thank you.

Yours faithfully

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ALL CORENET E-INFO SUBSCRIBERS
Summary for Design and Checking of Structural Elements
[to be submitted together by QP and AC]

Project Ref. No. : _______________________________   ST Ref No. : ________

Project Description: __________________________________________________
__________________________________________________________________
__________________________________________________________________
__________________________________________________________________

Summary of Structural Elements Sheet
AC should ensure that he has checked all the key structural elements.

<table>
<thead>
<tr>
<th>S/N</th>
<th>Type of structural elements*</th>
<th>Element markings in structural plan</th>
<th>QP Design Calculations$^2$</th>
<th>AC$^1$ Design Calculations$^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Element markings$^3$</td>
<td>Page numbers</td>
</tr>
<tr>
<td>1</td>
<td>Footing</td>
<td>F1 to F4, F4a, F5 to F7</td>
<td>Same as plan</td>
<td>5-15</td>
</tr>
<tr>
<td>2</td>
<td>Level 1 Beams</td>
<td>1B1 to 1B10</td>
<td>A-1 to A-10</td>
<td>16-30</td>
</tr>
<tr>
<td>3</td>
<td>Level 2 Beams</td>
<td>2B1 to 2B5, 2B6 (transfer), 2B7 to 2B10</td>
<td>A-11 to A-20</td>
<td>Refer to Level 1 Beams</td>
</tr>
<tr>
<td>4</td>
<td>Typical Floor Beams</td>
<td>3B1 to 3B10, 4B1 to 4B10</td>
<td>A-21 to A-40</td>
<td>31-55</td>
</tr>
<tr>
<td>5</td>
<td>Columns</td>
<td>1C1 to 1C8, 2C1 to 2C8, 2C9 to 2C10 (transfer), 3C1 to 3C10</td>
<td>Same as plan</td>
<td>56-71</td>
</tr>
<tr>
<td>6</td>
<td>Slabs</td>
<td>S1 – S10</td>
<td>Same as plan</td>
<td>72-90</td>
</tr>
<tr>
<td>7</td>
<td>Steel Connections</td>
<td>Details A - G</td>
<td>Same as plan</td>
<td>91-101</td>
</tr>
</tbody>
</table>
Annex A1

<table>
<thead>
<tr>
<th>S/N</th>
<th>Type of structural elements*</th>
<th>Element markings in structural plan</th>
<th>QP</th>
<th>AC¹</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Design Calculations²</td>
<td>Element markings³</td>
<td>Page numbers</td>
<td>Element markings³</td>
</tr>
</tbody>
</table>

* All structural elements in the project to be designed/checked, e.g. piles/earth retaining structures/retaining walls/columns/walls/ beams/slabs/staircase/barrier.

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¹ AC to indicate ‘NA’ for elements not checked for under his scope.
² Design calculations shall be as defined in Building Control Regulations Section 9.
³ Where QP/AC indicates element markings in design calculations as “same as plan” or equivalent, all the structural elements listed under “Element markings in structural plan” shall be deemed to be designed and checked by QP/AC.

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Summary for Design and Checking of Structural Elements  
[to be submitted by QP and AC separately]

Project Ref. No. : _______________________________   ST Ref No. : ________

Project Description: __________________________________________________

__________________________________________________________________

__________________________________________________________________

Grouping of Structural Elements Sheet

<table>
<thead>
<tr>
<th>S/N</th>
<th>Type of structural elements*</th>
<th>Element markings in structural plan</th>
<th>Designed structural elements that are similar</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Beam or N.A.</td>
<td>3B1, 3B2, 3B3, 3B4, 3B5 or N.A.</td>
<td>2B1, 2B2, 2B3, 2B4, 2B5 or N.A. [to indicate N.A. if there is no grouping in the design]</td>
<td>Typical floor</td>
</tr>
</tbody>
</table>

* All structural elements in the project to be designed/checked, e.g. piles/ earth retaining structures/ retaining walls/ columns/ walls/ beams/ slabs/staircase/barrier.

Stamp & Signature of Qualified Person/ Accredited Checker
Format of design calculations and essential information to include

(1) Design calculations should be in PDF format that is able to allow searching base on key words

(2) For the Structural Summary Sheet, to provide a synopsis of the structural design giving –

(i) a general description of the foundation and structural system and the basic anatomy of stability by which the applied loads are transferred to the ground; and

(ii) design method, assumptions, codes used and limitations of stresses and deformation

(3) For the analysis software used, it should include

- Design input data with computer-generated graphics or hand sketch showing the framing & layout of the structure, location of nodes & elements, joint fixity, element section assignments (refer to Figures 1 to 3), loadings (refer to Figures 5 & 6), materials, etc.

- the floor layouts with markings of all structural elements (refer to Figure 4)

- summary of salient output results (including pictorial illustrations) e.g. the design envelopes of moment, shear, displacement of the most critical cases for the design and check of the applied forces against the output overall reaction (refer to Figures 7 to 12)

- the interpretation and application of the computer output in the design;

(4) Essential information on the design to resist wind load, including–

- a general description of the wind-resisting system and mathematical modelling;

- diagrams illustrating the location and identification of all structural frames and members in the wind-resisting system;

- principal reactions (moments, shear forces and axial forces) in the wind-resisting elements; and

- a summary of equilibrium checks on applied lateral forces and calculated reactions of vertical structural members at foundation and other critical levels where there is a major change in structural configuration
(5) Essential information on the design to resist dead and imposed loads, including—

- the **design data on dead and imposed loads** (including allowance for partitions, screeds, dynamic effects and the like); and

- a **summary of principal reactions** (moments, shear forces and axial forces) in vertical structural members at foundation and all floor levels;

- Details of the **design of major transfer members** where the failure of which would induce cumulative instability; and

- Details of the **design of cantilevered canopies, balconies and major structural appendages**
Examples of framing and layout of the structure in Design Calculations

Fig. 1 - 3D illustration of analysis model
Fig. 2 - Plan layout with beam/slab section properties in design calculations
Fig. 3 - Elevation with column section properties in design calculations
Example of presentation of element markings in Design Calculations if they are different from plan

Fig. 4 - Beam layout in design calculation and structural plan

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Examples to show load inputs clearly in Design Calculations

Fig. 5 - Visual representation of loadings on slabs

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WALL LOAD (kN/m)

Fig. 6 - Visual representation of loadings on beams
Examples of Summary of Design in Design Calculation

Fig. 9 - Summary of beam design with the beam labels in one plan (same as structural plan)
Fig. 10 - Summary of beam design with beam labels
Fig. 11 - Beam design and beam layout plan shown in design calculations
Annex B

Fig. 12 - Beam analysis and design with beam markings (same as structural plan) shown in design calculation.
Recommended Design Workflow using BIM

Import A&D model with properties
(e.g. element ID, geometry, dimensions, material properties, support conditions)

DATA EXCHANGE between models through available plug-ins

Update A&D model properties
(e.g. geometry, dimensions, material properties) from BIM model

*A&D model refers to 3-D model in the analysis & design software